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ABSTRACT

This paper questions the acceptance of injuries obtained while participating in sport and in particular, the relationship between participation in boxing and brain injury/damage identified in boxers. A review of the literature indicates research findings support the tenet that brain damage found in boxers is cumulative and is directly related to the period of time individuals actively participated in the "sport". Since the central nervous system, and in particular the brain, has been found not capable of cell regeneration or preconditioned to accept trauma, the apparent risks of boxing outweigh the reported benefits to individuals and society. Ideally, boxing should be banned because of the potential for irreversible brain damage to contestants. Since this does not appear to be realistic at this time, some recommendations offered for limiting potential brain damage for boxers are included. (JD)

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Be Allowed To Box ?

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In the clearing stands a boxer,
And a fighter by his trade
And he carries the reminders
Of ev'ry glove that laid him down
And cut him till he cried out
In his anger and his shame
"I am leaving, I am leaving"
But the fighter still remains
Lie la lie ...

The Boxer

Simon & Garfunkle

When discussing the philosophy of sport, Simon (1985) related a narrative pertaining to Socrates' search for the wisest person in Greece. Socrates was surprised when informed by the Oracle of Delphi that he, Socrates, was the wisest individual. The author further suggested that Socrates' wisdom was demonstrated by his willingness to critically question his personal beliefs. In reviewing sport history, Mandell (1984) pointed out that a critical analysis of American sport was generally lacking. He particularly noted:

"that a critique of American sport has been so feeble ... But few protested. ... American sports analysis ... remains overwhelmingly descriptive and appraising." (p. 280)

The institution of Sport has not been without recognized critics. One critic of American Sport, Nixon (1984), employed a sociological perspective to analyze the myths and realities of fulfillment of the American Dream through sport. He observed that the goals of achievement, mobility, and success (i.e., the American Dream) served as a significant motivating force for most Americans. The value of incorporating a sociological framework to examine American sport was explained in the following passage of Nixon (1984):

"Sociological questions are motivated by an interest in looking critically at the commonly accepted, or officially defined, descriptions and explanations of social behavior. Sociologists do not accept beliefs about society or a social interaction merely because they are widely accepted." (p. 11)

Within the field of sports, the regular reporting by the

media of injuries sustained by athletes while participating in sports such as football, hockey, baseball, and boxing is common place and often accepted as a "natural part of the game". This paper wishes to question the acceptance of injuries obtained while participating in sport and in particular, the relationship between participation in boxing and brain injury/damage identified in boxers.

Dean & Hoerner (1981) reported that an individual has a 50% chance of being injured while actively involved in sports. Although the authors indicate many injuries are "minor" they also succinctly denote "all injury is damage". These authors also posed an interesting question they left unanswered: - "What does society trade off for these injuries and deaths?" (p. 41). After conducting a 12 month review of injuries occurring in individuals resulting from their participation in sports, Smithers & Myers (1985), perceived the public sorely lacked knowledge of the extent of injury occurrence when they stated " ... public awareness of the true size of this epidemic [i.e., injuries sustained from sports injuries] is lacking" (p. 457). The authors also viewed injuries as an obvious consequence of sport participation and encouraged a closer examination of the cost of these injuries to the community. A flow-chart depicting the variables involved in identifying, diagnosing, treatment, and treatment follow-up has been devised by Tolpin & Bentkover (1981) (see appendix A). These authors also provided an analysis of the economic cost of injuries sustained by a 25 year old male participating in ice hockey and

a 20 year old male playing football (see appendix B). Two major purposes of presenting the flow chart and respective injury costs are to portray the economic costs of a sports injury to the individual, while also recognizing the multiple services required of an injury to the athlete.

In another discussion pertaining to sport injuries, Tutko (1981) reflected on the impact of a person's attitude toward an injury. The author stated that athletes generally fail to realistically view an injury and the related pain. These concerns are stated in the following declaration

"We feel it is the mature and macho thing to play with pain. To teach young people to do that is to go against nature, since pain is nature's way of telling us something is wrong. ... To train a child to lie about pain regardless of injury is foolish and short of being criminal." (p. 337)

A current T.V. advertisement incorporates verse from a popular Carly Simon song that portrays the "forget about pain mentality". The verse - "I haven't got time for the pain" is followed by an advertisement suggesting the ingestion of a particular medication when a person experiences specific physical pain so that the person may continue engaging in their particular activity.

Having discussed some general issues pertaining to sports injuries, the remainder of the paper will address concerns regarding head injuries sustained by contestants within the field of boxing. Approximately 60 years ago Martland (1928)

voiced concern that prize fighters (i.e., Boxers) may be affected by a syndrome labeled "Punch Drunk" and reported "that special brain injury due to their occupation exists ..." (p. 1103). He further related that in the progressive stage of the disease, the symptoms of "Punch Drunk" frequently mimic the Parkinsonian disease. The author also requested this medical condition be addressed by both the medical profession and the general public. Related to this perspective is a recent and brief newspaper article which reported that former heavy weight champion Muhammad Ali was planning a trip to Mexico so that a medical consultant would evaluate the feasibility of an operation on his brain (Syracuse Newspapers, 1987). The stated purpose of the operation under consideration was to alleviate Ali's apparent symptoms of Parkinson's disease. It should be noted while the former heavy wight was active in boxing, he was strongly warned to cease boxing as brain injury was suspected. At that time, further participation in boxing was believed to most likely exacerbate Ali's questionable neurological status.

The type of ^{SIGNIFICANT} head injury that typically occurs in a boxer is the closed head injury. The seriousness of brain damage resulting from a closed head injury should not be underestimated since extensive and irreversible damage may occur to an individual without the person sustaining a skull fracture (Reitan, R., & Wolfson, D., 1985). These authors particularly noted that "mortality and morbidity resulting from head injury are major medical and neuropsychological problems." (p. 237)

In a paper discussing neurologic injuries in boxers, Charnas & Pyeritz (1986) reported contestants may experience acute and chronic boxing related brain injuries. Acute injuries generally are perceived during a boxing event or briefly after the match has been completed. The authors also noted the interruption of consciousness via a concussion (i.e., a knockout) was the most common form of acute injury. Chronic injuries were viewed as developing over an extended period of time, and having a more serious effect on the brain than revealed by clinical observations.

Cantu (1982) also emphasized that injury to the brain results in permanent cell loss and specifically noted that:

"the central nervous system housed in the skull and spine is not capable of regrowth, transplantation, or replacement with artificial hardware." (p. 125)

He further stated that once the brain has been traumatized, it is more susceptible to sustaining another injury. In addition to an injured brain being more susceptible to further injury, the possible additive effect of more than one concussion has been studied and will now be discussed.

The cumulative effect of concussion has been examined by Gronwall & Wrightson (1975); these authors studied 20 adults who received two concussions and a control group whose members each received only once concussion. Findings of the study revealed that individuals in the experimental group, when compared with the control group, had more difficulty processing information and required a greater amount of time to recover

from the adverse affects of the second concussion. Interpretation of these findings suggested the effects of a concussion seem to be cumulative. Finally these authors cautioned against the uncritical acceptance of concussion injury in sports. Further support for the cumulative effects of concussion may be found in Saunders & Harbaugh's (1984) recent case study of a 19 year old college football player who was struck in the head during a fist fight and briefly lost consciousness. Although the player reported a mild headache three days after sustaining the blow to the head, he was allowed to resume football practice. The following day the individual collapsed on the practice field and died several hours later. An autopsy was performed and the authors found that the player possessed a preexisting cerebral contusion and concluded that the second impact had an additive and lethal effect. The authors also recommended the administering of a Computed Tomographic scan (CT) before an athlete who sustains a concussion is permitted to resume engagement in the sport. Use of the CT scan was urged since it:

"allows the 'insignificantly' head-injured athlete to be more objectively assessed and may show major intracranial pathological conditions not appreciated by clinical examination alone." (p. 539)

Reported research findings of brain damage in boxers will now be reviewed. Atha et al (1985) measured specific properties of a simulated boxing punch to demonstrate the velocity of a punch to the head delivered by a professional

boxer. Findings of this study revealed that the velocity of a punch on impact was approximately 20 miles per hour. The force of this impact was viewed to be severe enough to cause adverse medical consequences to the area of the brain. Direct blows to the head are not the only potential source of head injury in boxers; indirect head injury via the impact on the chin and when the boxer's head makes contact with the canvas after being dazed or knocked out may both result in concussive effects (Williams & Sperry, 1976).

Further evidence supporting the negative effects of boxing on the brain were reported by Kaste et al (1982). Fourteen boxers (i.e., six professionals and eight amateurs) were examined and indications of chronic brain damage were found in five professionals and four amateurs. It was also reported that apparent brain damage was less frequent and less progressed for amateurs than found in the professional boxers. These findings support the perspective of the cumulative effects of repeated brain trauma previously suggested. The authors also concluded that brain injury to boxers can only be prevented by disallowing punches to the head. Along the same vein, Casson et al (1984) examined 15 professional and three amateur boxers for evidence of brain damage. The procedure utilized in the evaluation consisted of a neurological examination, EEG, CT scan of the brain, and neuropsychological testing. Evidence of organic cerebral dysfunction was observed in 13 of 15 professionals. Further evidence indicative of subtle brain injury was found in the remaining five subjects. A review of the subjects number of professional

fights and age also suggested a direct relationship between the severity of brain damage and the length of a boxer's professional career. The researchers also concluded that: "A cumulative effect of multiple subconcussive blows to the head is a likely etiology." (p. 2666) for the more severe brain damage.

In a recent study of 19 young, active licensed professional boxers Drew et al (1986) reported 15 of the 19 boxers obtained neuropsychological test scores within the impaired range. The specific testing results suggested the degree of brain damage found in the subjects parallels past reports of brain damage found in boxers who had extended active boxing careers.

Despite the findings of various researchers and clinical reports of head injuries sustained by boxers over the decades, controversy exists as to whether boxing should be allowed or banned. As noted in an editorial of The Journal of The American Medical Association (Lundberg, 1984) opponents of boxing have been credited with comments such as:

"Boxing is not a sport but a gladiatorial contest in which two men try to beat each other senseless ..."

... Boxing is a sacrifice of living flesh to the mere titillation of spectators ...

... Every boxing match is, by definition, aggravated assault ...

... When animal fights are outlawed by civilized society, where does that leave professional boxing?" (p. 2696)

An earlier JAMA Council Report (Battalia et al, 1985)

viewed in dismay the fact that boxing was the only sport which allowed the participants to inflict pain and injury on each other. The Council Report further emphasized that the available boxing equipment was not able to fully protect the brain from injury.

Proponents of boxing point out the sport does not offer any additional danger than other allowable sports in society (Battalia et al, 1983). Further arguments to support boxing have included positions such as:

"Boxing is a voluntary endeavor ...
... Boxing builds discipline and confidence, and it draws ghetto kids away from a life of crime ..." (Lundberg, 1984; p. 2696)
"Physicians shouldn't give medical opinions about boxing's effect on the brain without conclusive research ...
... The AMA is pushing moral judgement ...
... Ban boxing and we'll have back-alley fights again ...
... A boxing ban will just force the sport underground where the standards will be worse ..." (NASH, 1986; p. 73)

Summary and Conclusions

A review of the above literature indicates research findings support the tenet that brain damage found in boxers is cumulative and is directly related to the period of time individuals actively participate in this 'sport'. Studies pertaining to the impact of closed head injuries on the

central nervous system conducted over the past decade also serve as a mechanism for assessing the potential dangers of boxing (Schneider et al, 1985). Since the central nervous system and in particular the brain, has been found not capable of cell regeneration or preconditioned to accept trauma, this writer perceives the apparent risks of boxing outweigh the reported benefits to individuals and society. In addition, concern about boxing and it's negative effects on individuals has not solely focused on adult subjects. Lundberg (1934) pointed out the American Academy of Pediatrics has viewed adolescent boxing from a negative perspective, taking the position that:

"boxing with its potential for head trauma and primary goal of producing injury, is not an appropriate sport for any young person."
(p. 2697)

Although injury rates in boxing have been viewed as comparable or less than many other sport injury rates, the 'sport' of boxing is different since the nature of the contest fosters the intentional injury (i.e., knockout) of an opponent. Because of the potential debilitating effect of head trauma, injuries to the head should not be accepted as a natural part of boxing or any sporting event. The occurrence of head injuries received by individuals participating on other sports (i.e., bicycling, football, hockey, soccer, and rugby) should also be critically examined.

The following recommendations are offered:

- (1) Ideally, boxing should be banned because of the potential for the irreversible risk of brain damage for contestants. As the banning of boxing does not appear realistic at this time (Lundberg, 1984), then individuals under the age of legal consent should not be allowed to participate in boxing events due to the reported inherent risk of brain injury.
- (2) Baseline data on neurological and neuropsychological functions should be obtained on the aspiring boxer's physical health and cognitive skills (i.e., short and long term auditory and visual information processing skills; tactile memory skills) when they initiate their career. Subsequent medical and neuropsychological data should also be obtained on a periodic basis to monitor the health and cognitive skill levels. Results from these tests would be used in providing a composite picture of an individual's present neurological status.
- (3) Individuals considering boxing and active boxers should be provided with appropriate educational materials which discuss the potential negative effects of boxing.
- (4) Athlete's should receive pain education information which: a) discusses pain as being a sign of injury; and b) informs individuals of physical symptoms which suggest an injury has occurred so that early medical intervention may be appropriately procured.
- (5) Boxers should receive alcohol and other drug education materials and also be encouraged not to abuse alcohol

and other drugs which are known to adversely affect the functioning of the brain. The abuse of these drugs along with the cumulative effect of blows to the head may result in an interaction which would exacerbate the effects of present brain injury. Research into this area of concern is encouraged.

- (6) Permitting an individual with a preexisting brain dysfunction such as seizure disorder or learning disability to participate in boxing or any contact sport appears to place these individuals at risk for further brain damage. Especially since the potential for further trauma occurring appears greater when a preexisting brain dysfunction is present. If these identified individuals choose to engage in sports, they should be encouraged to participate in non contact sports rather than contact or collision sports.
- (7) As some authors (Cantu, 1982, Dorsen, 1986) have argued the absence of a paired internal organ should eliminate an individual's participation in collision or contact sport, perhaps individuals with only one brain should not be allowed to participate in boxing matches.

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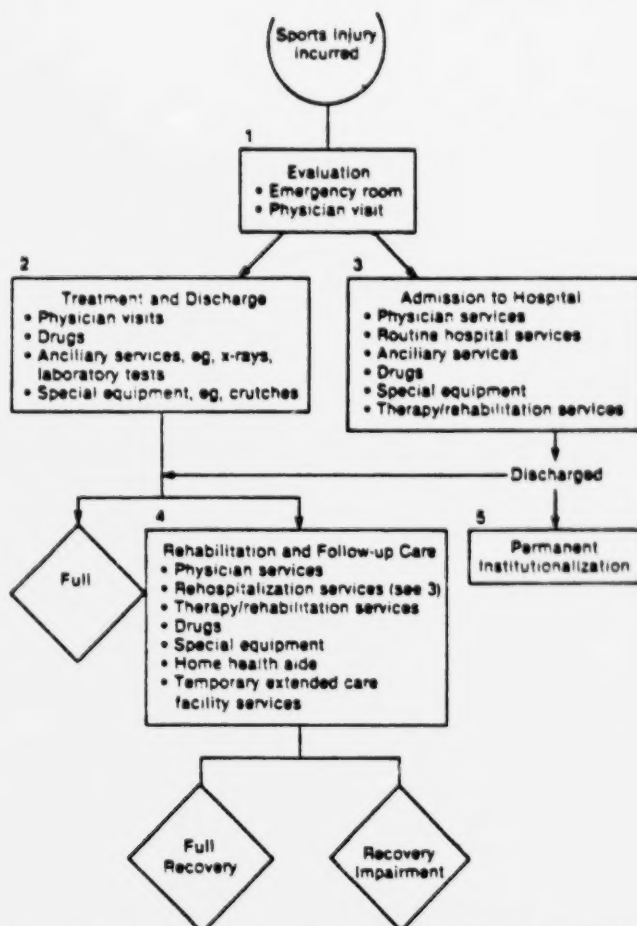


Figure 6-1 Treatment and resource requirements of a sports-injury patient.

**Economic Cost of an Ice Hockey Injury:
Severe Corneal Abrasions in a 25-year-old Man**

Direct Costs*	
Emergency room visit	\$ 52
Complete exam by ophthalmologist	36
Four follow-up visits at \$21	84
"Soft bandage" contact lens	180
Three follow-up visits at \$21	63
Six days' hospitalization at \$263 per day	1570
MD cost	156
Four follow-up visits at \$21	84
Corneal transplant	
Five days' hospitalization at \$262 per day	1308
Surgical fees	1248
Assistant fee	250
Anesthetist fee	260
Four follow-up visits at \$21	84
Total direct costs	\$3375
Indirect Costs (Work days lost at \$68.30 per day)†	
MD visits, 15 visits at 1/2 day each	513
Corneal ulcer treatment, 10 days	683
Corneal transplant, 21 days	1435
Insurance administration costs‡	210
Total indirect costs	\$2841
Total Economic Costs	\$8216

*These costs are based on actual unit costs inflated to fiscal year 1980. Detailed calculations are available from the authors upon request.

†Earnings data are based on Arthur D. Little, Inc. estimates prepared for the National Center for Health Services Research, Office of the Assistant Secretary for Health Research, Statistics, and Technology, Public Health Service US Department of Health, Education, and Welfare pursuant to Contract No 233-78-3013.

‡Insurance administration costs are assumed to be equivalent to 3.9% of total direct cost expenditures.

**Economic Cost of a Football Injury
Severe Spinal Cord Injury (in SFY 1980)**

	6%	10%
Direct Costs*		
Initial Costs	\$101,858	\$101,764
Emergency assistance		
- Ambulance @ \$75		
- Emergency room treatment Services @ \$437		
Initial hospitalization		
- 235 days @ \$378 = \$88,830		
Home modifications @ \$9946		
Vocational rehabilitation†	2570	2476
Annual Costs	228,442	166,343
Medical equipment and appliances \$554/yr		
Attendant care costs 6 hr/day @ \$5.10/hr for 330 days = \$10,710/yr		
Rehospitalization 15 days/yr @ \$378/day = \$5670/yr		
Drugs and medical services \$1126/yr		
Miscellaneous service and supplies \$895/yr		
Total Direct Costs	\$330,300	\$268,107
Indirect Costs		
Foregone earnings‡	394,740	233,306
Insurance administrative costs§	12,882	10,456
Total Indirect Costs	407,622	234,762
Total Economic Costs	737,922	\$11,869

*These costs are based on actual unit costs inflated to SFY 1980. Detailed calculations are available from the authors upon request.

†A one-time cost assigned to the year following the onset of injury.

‡Earnings data are based on Arthur D. Little, Inc. estimates prepared for DHEW, NCHSR pursuant to Contract 233-78-3013.

§Insurance administration costs are assumed to be equivalent to 3.9% of total direct cost expenditures.

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